雲端 Cloud Computing Center for Mobile Applications

ITRI Cloud OS: An End-to-End OpenStack Solution

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Cloud Service Models

Software as a Service (SaaS)

Turn-key software hosted on the cloud and accessible through the browser

Example: salesforce.com, and all major desktop software vendors

Hotel

Platform as a Service (PaaS)

Furnished Apartment

An operating environment including (application-specific) libraries and supporting services (DBMS, AAA)

Example: Google's App Engine, Microsoft's Azure, IBM's XaaS

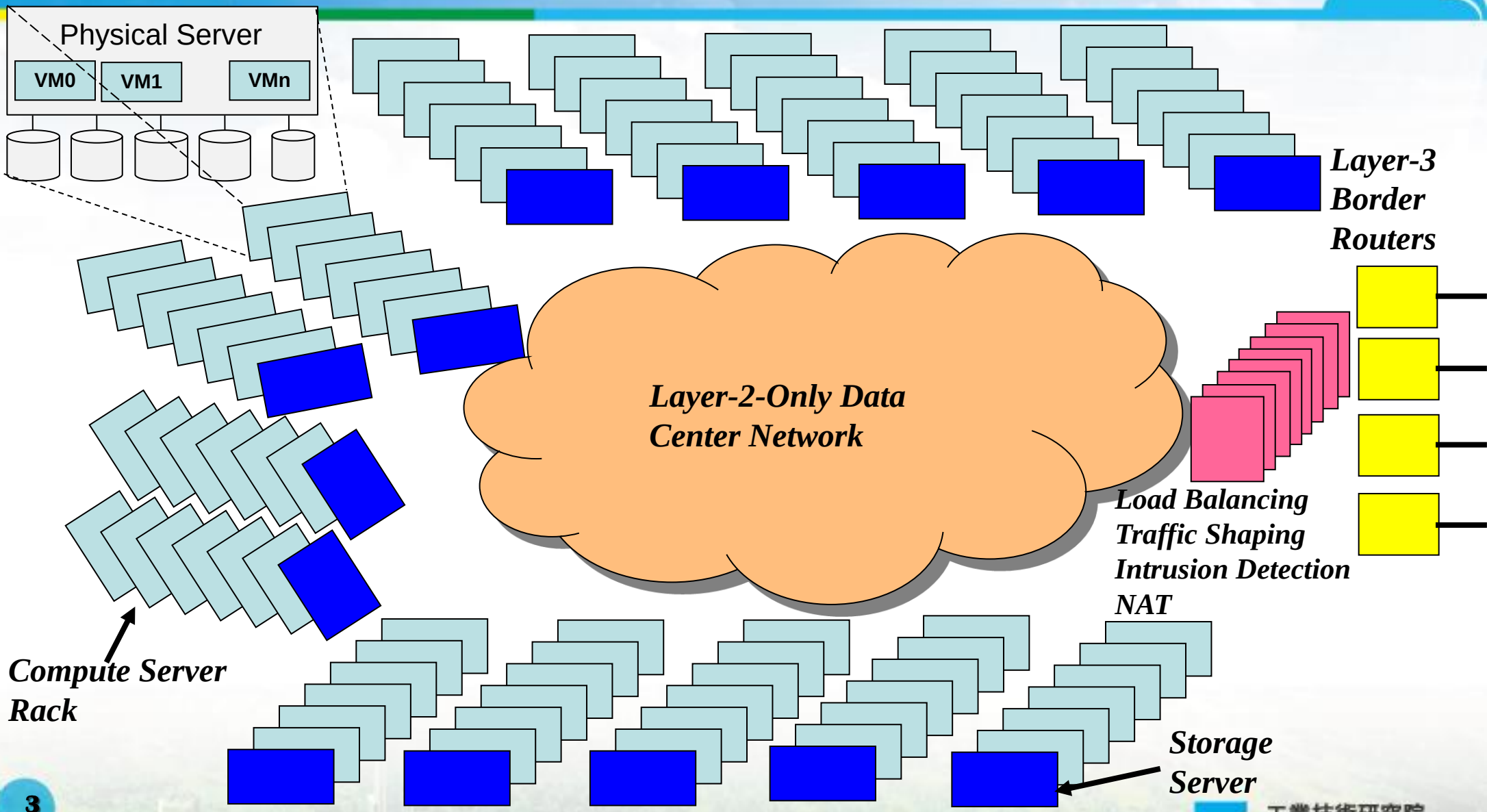
Infrastructure as a Service (IaaS)

A set of virtual machines with storage space and external network bandwidth

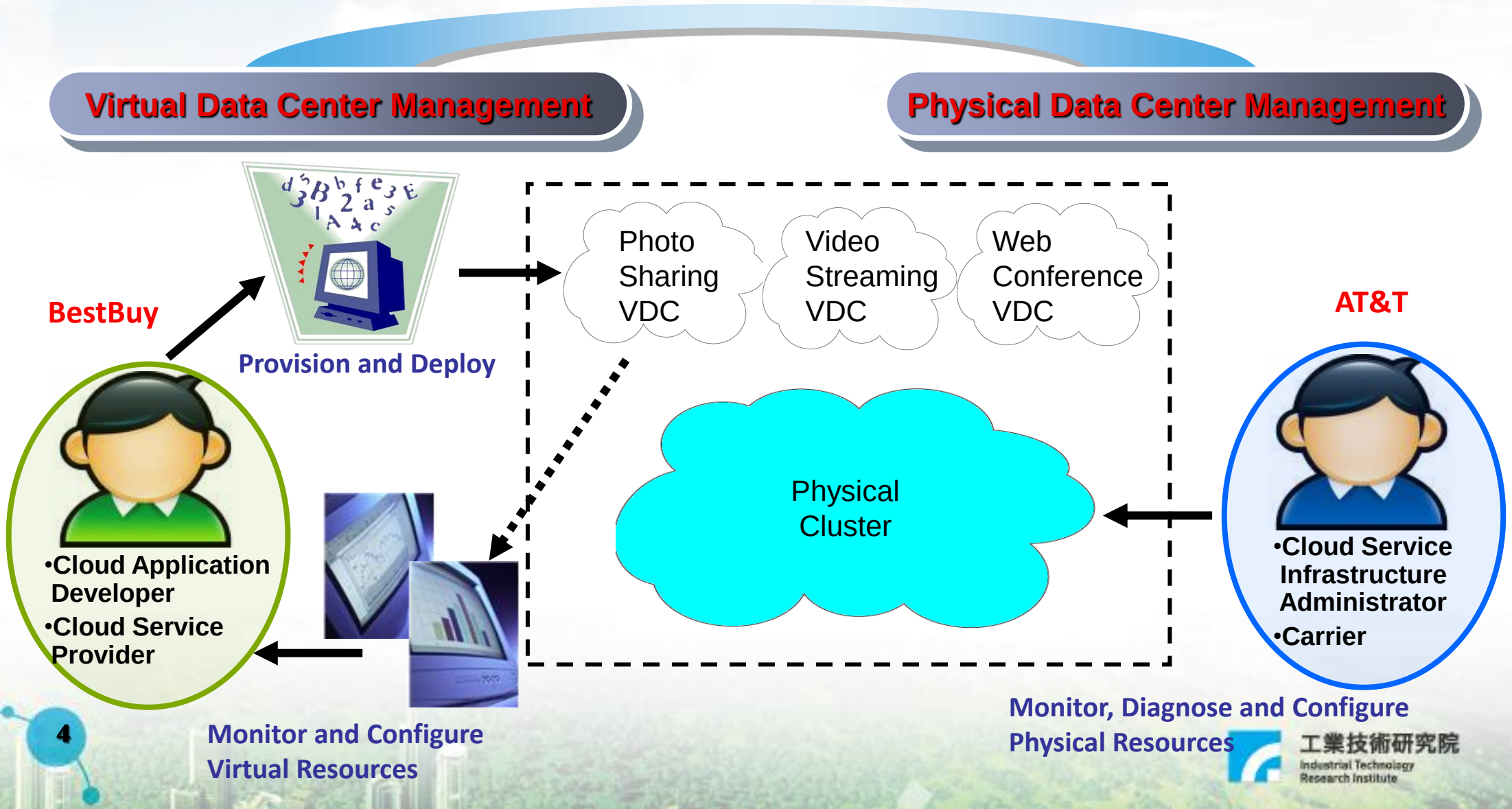
Example: Amazon Web Service

Unfurnished Apartment

Beyond Server Virtualization



Data Center Virtualization



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ITRI Cloud OS Service Model

- Multi-tenancy support from the grounds up
- Virtual data center ➔ virtual cluster ➔ VM
- Users provide a Virtual Cluster specification
  - No. of VM instances each with CPU performance and memory size requirement
  - Per-VM storage space requirement
  - External network bandwidth requirement
  - Security policy
  - Backup policy
  - Traffic shaping policy
  - Load balancing and auto-scaling policy
  - Network configuration: public IP address and private IP address range
  - OS image and application image

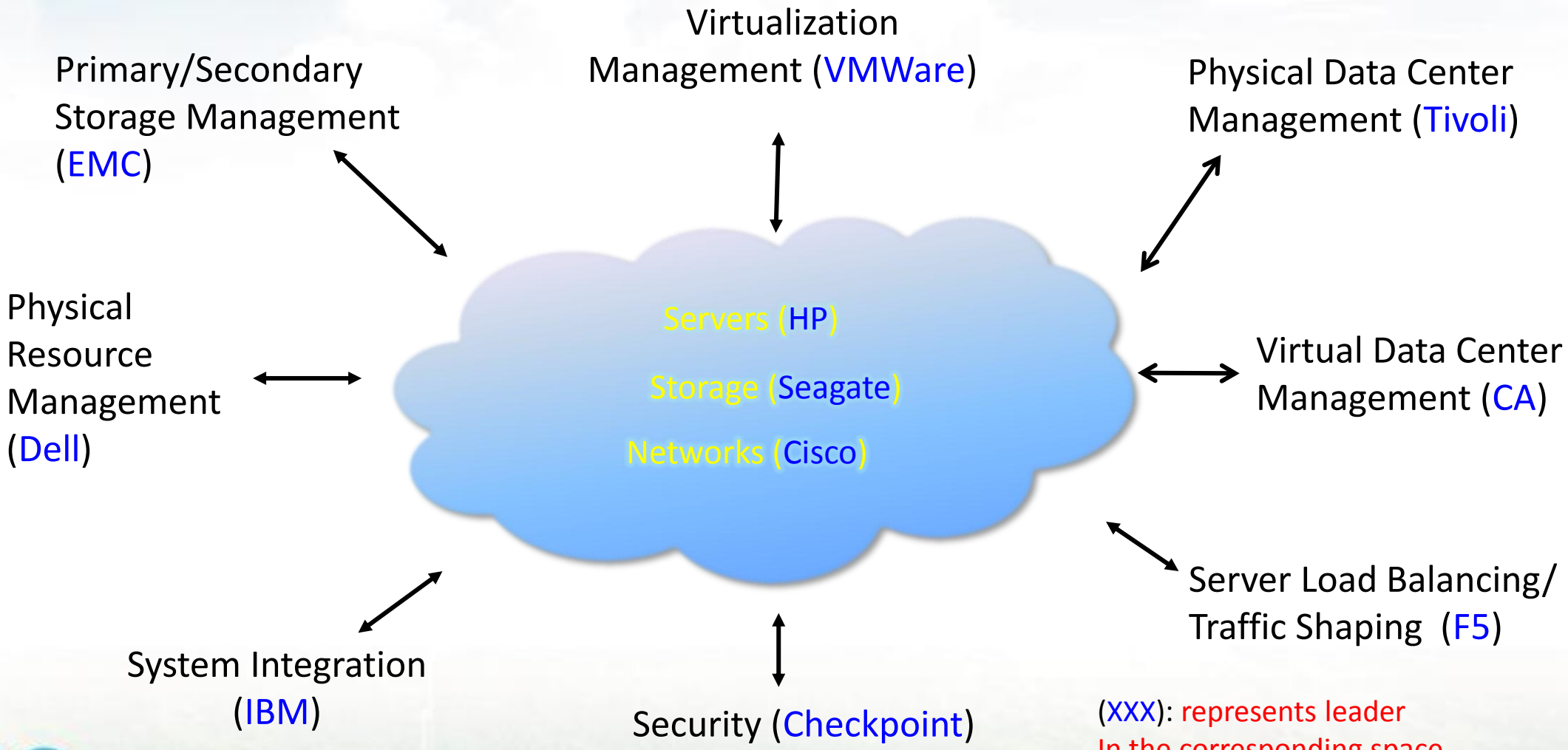
Components of ITRI Cloud OS

- Physical resource management (PRM): BIOS
  - Centralized installation of all systems and applications software
  - Start up, discover, shut down, and recover a data center computer
- Data center storage management: file management
  - Main storage (DMS) : Forming a highly available global storage pool from a set of distributed JBOD storage servers
  - Secondary storage (DSS): Offering streamlined disk-based snapshot and backup with configurable policy
- Virtualization management: process management
  - Resource provisioning management (RPM): allocate physical data center resources for a given virtual data center and auto-scaling
  - Dynamic virtual resource management (DVMM): use VM migration to support consolidation, load balancing and fault tolerance

Components of ITRI Cloud OS

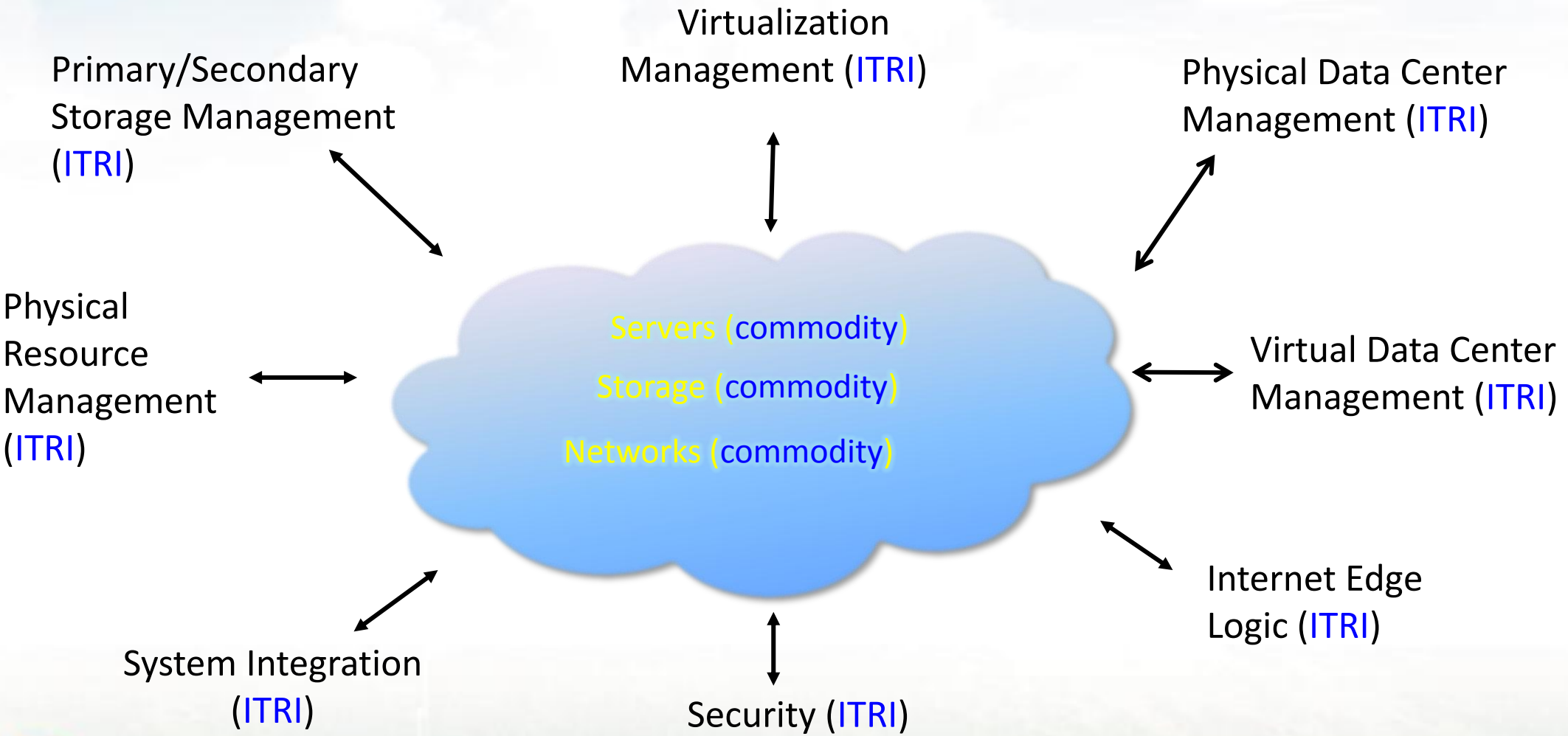
- Physical data center management (PDCM): system administration
  - Comprehensive server/switch/disk/software monitoring
  - Unified event log collection and analysis
  - Application performance management
  - Integrated trouble ticking support
- Virtual data center management (VDCM): system administration
  - VDC/VC/VM specification
  - **Real–time resource usage and application performance measurement**
- Security: security
  - Inter-VDC isolation
  - Centralized L3 and distributed L7 and web application firewalling
- Internet edge logic: WAN appliance
  - Inter-VM load balancing within a VC
  - Traffic shaping
  - DDoS attack mitigation

Building Cloud Data Center



(XXX): represents leader
In the corresponding space

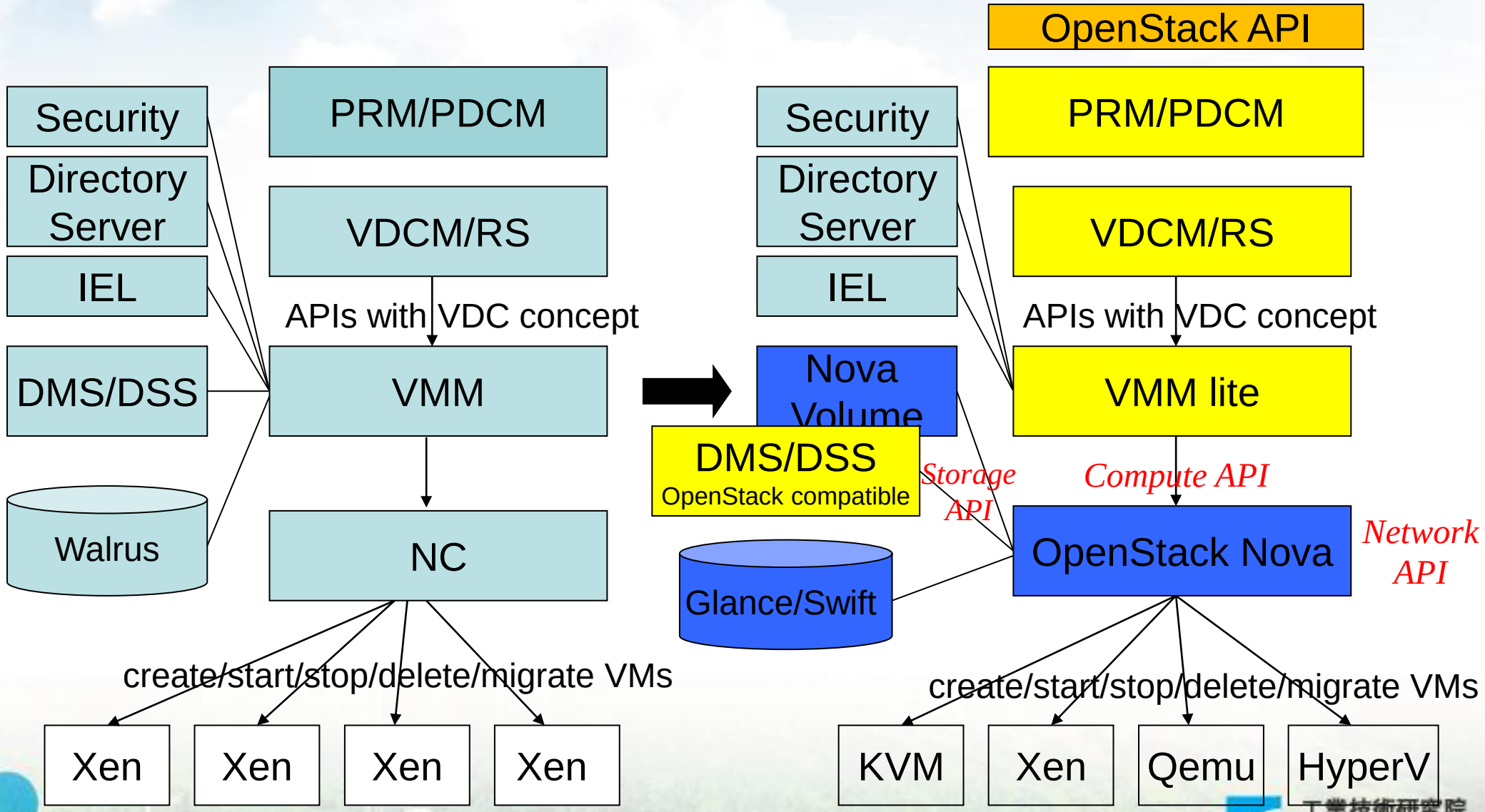
ITRI Cloud OS's Way



OpenStack

- Open Stack core + API for third-party plug-ins
  - Nova: Virtual machine service
  - Glance: VM image upload and delivery
  - Swift: Object storage
  - Cinder: Virtual block storage service
  - Quantum: Virtual network service
- Improvement over Nova
  - Boot from remote cloned volume
  - Inter-physical-machine load balancing
  - Power consolidation
  - Dedicated physical machine pool
  - Auto-scaling

OpenStack-Compatible Cloud OS



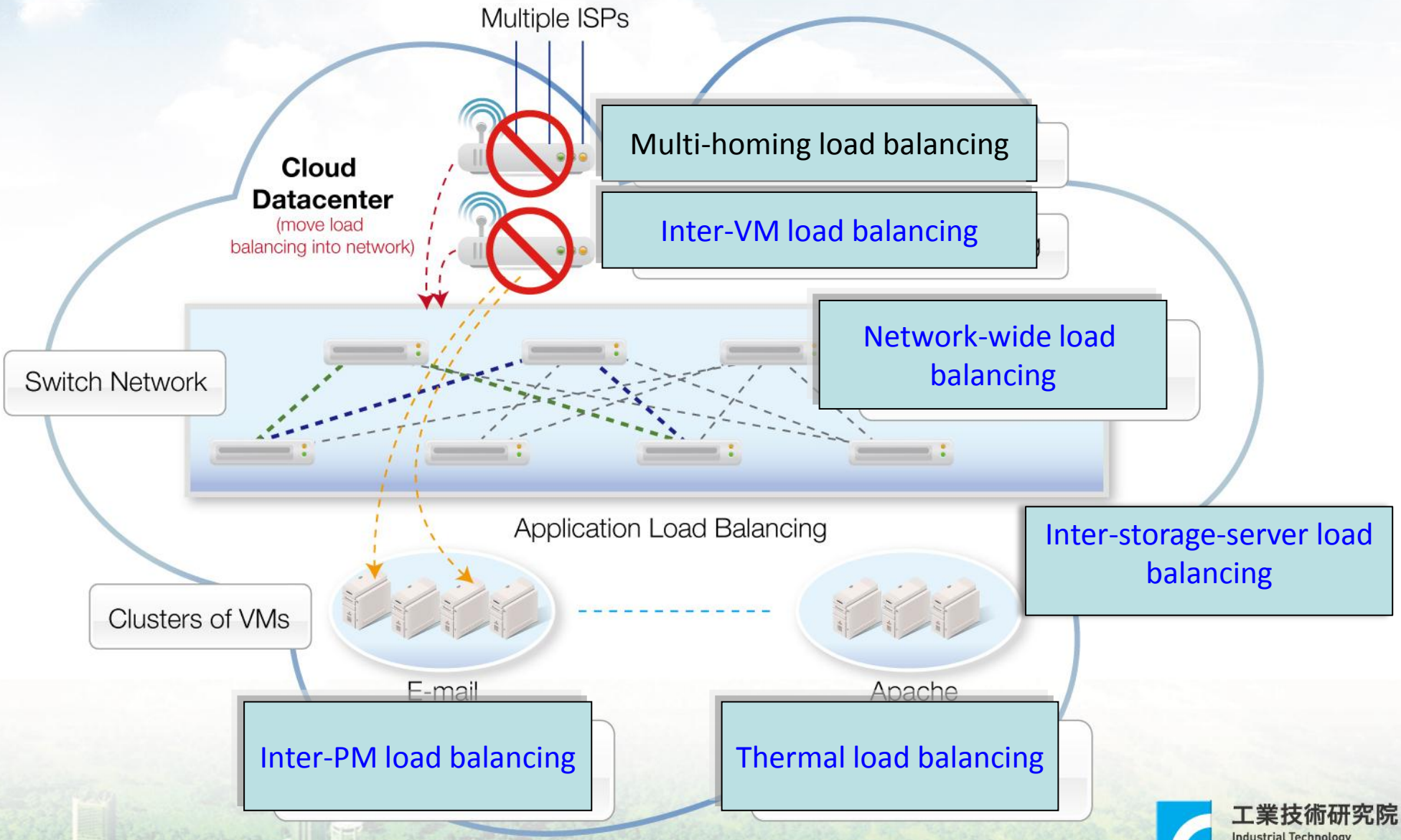
Strong Data Protection

- Storage hardware: JBOD-based (just a bunch of disks) storage servers
- RAID: disk failure
- N-way data replication: disk, controller, server, and network failures
- Periodic snapshots for local data backup with de-duplication: manual error
- Wide-area data backup: site failure
  - Snapshot frequency: a couple of hours to days

High Availability Support

- High availability support for Cloud OS subsystems
  - Active-passive: Linux HA + DRBD + edit logging/recovery
  - Active-active: MySQL and server load balancer
- Disk state-preserving fail-over for application VMs running inside VDCs
  - Shared persistent state + VM restart + take-over

Scalability: Multi-Dimensional Load Balancing



Cloud Security

- Any security breaches that are possible for a physical data center are equally likely for a virtual data center
  - L4/L7 and Web Application Firewall
- New security concerns
  - Inter-VDC isolation vs. VLAN isolation

Network Virtualization

- Multiple virtual networks on top of a single physical network
- Each VDC has its own virtual network
  - A single virtual L2 switch connecting all the VMs in a VDC
  - A full private IP address (i.e. 10.x.x.x)
  - VPN connections connect VDCs that share the same IP address space
  - Per-VC firewall, server load balancing and traffic shaping policy
  - Assigned public IP addresses
  - Is VLAN needed in the network virtualization model?
- Support private IP address reuse without tunneling: A private IP address such as 10.1.2.5 could be used in multiple VDCs simultaneously

System Management/Administration

- Separation between PDC operator and VDC operator
  - Multi-tenancy aware
- Comprehensive monitoring
  - Server/switch/storage sensors
  - Systems software health
- Virtual to physical resource mapping
  - Virtual Machines ➔ Physical Machines
  - Virtual Volumes ➔ Physical Disks
  - Virtual Network Links ➔ Physical Network Links
- Unified log collection and access

Summary

- ITRI Cloud OS is a fully integrated IaaS solution for both public, private and hybrid cloud
- Compatible with OpenStack (since Essex distribution)
- Key features:
  - Distributed replicated block storage
  - PDCM/VDCM separation
  - Network virtualization on Ethernet network without tunneling

Thank You!

Questions and Comments?

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